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NAVY ELECTRONICS LAB SAN DIEGO CALIF
A PLOTTING PROGRAM FOR THE DATATRON 220. (U)
SEP 60 W P HOUSSAYE

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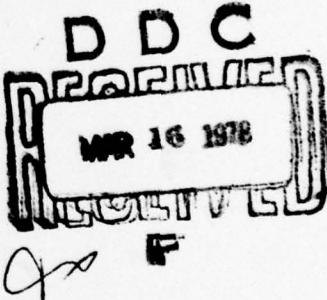
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A PLOTTING PROGRAM FOR THE DATATRON 220

by

Willie P. de la Houssaye

INTRODUCTION:

When reducing data or doing computations on a computer, it is often desired to see what the results will look like when plotted. This has required either tabulation of the data followed by hand plotting, or punching cards and then using the small X-Y plotter to plot the cards. With the program presented here, data can be directly plotted from the computer without any intermediate steps, and at a faster speed than is possible by either of the above methods.

The result of this program is an X-Y plot on the IBM 407 page printer. The y values can have any range, and the increment of y can be selected, with the provision that each y value will take a line of print on the 407. The plotting is exact in that a point will be plotted only if its value is exactly that of the y value of that line. The program will plot from 21 to 120 points per graph, and will proceed to a new graph until all the points have been plotted.

The program may also be used as a subroutine with another program, where the other program may scale the data, find and set the limits on y, etc.

This program will not take a random arrangement of x values. The data in memory of the computer must be the y values for a sequential set of x values, such as would be in a time series, where the levels would be taken every minute, hour, or at any fixed interval.

407 PLOTTING:

This program will take data from memory of the Burroughs 220 computer and plot it directly on the IBM 407 page printer. This data must be in sequential order of x values, i.e., the first cell is the value of y for x[1], the second, the y value for x[2], etc. These numbers can be in either floating or fixed point. If they are in floating point, the program will convert them to fixed point and round them to whole numbers; if they are fixed, the decimal should be in the fifth place (i.e. $\pm 1234\ 5.0\ 0000$) and the numbers rounded to whole numbers. The program compares the sign and the first five digits of the number with the y value. The method of setting the constants is shown in the section on Ranges, and modifications for plotting to tenths can be made as shown in the Modifications section.

Also, the program can plot two curves simultaneously, the first curve being given preference over the second if the two have the same y value at a point. The first curve is plotted with "." as the points, and the second curve with "*" ; thus, if the two have a common point, only one y value will show for that value of x , and it will be a "." . Any number of points from 21 to 120 per graph may be plotted, with the end point repeated if desired, as would be done in a calendar plot where one would plot from midnight to midnight on a graph and would want the same midnight to begin the next graph.

The y values may be listed down the left hand column, if desired, and the graph can be separated from the y values if the number of points per graph is less than 116, with the use of program switches.

When plotting a long list of data, the number of lines per graph should be the same as the number of lines the 407 prints per page or a submultiple thereof, which is normally 58. Thus, with a y range of 29 lines (10-38, with a y increment of 1, for example) there will be two full graphs on a page. This lets the 407 skip to a new page for a new graph. However, each time the program is started, it will automatically advance the 407 to a new page.

The program will not plot zeroes whose sign is the same as the sign of the y increment.

A listing of the program follows the figures of this memo.

PROGRAM INFORMATION:

Input:

The program may be floated into any location of memory from cards by setting the B register to the desired location and using the service routine of S. W. and C. B. Porter (NEL Technical Memo 341) to load the cards. From paper tape, set B to the desired location and read in the tape to that location. The program is 300 words long and occupies relative locations 0000 - 0299.

There is no provision for loading data in the program. Data may be stored in the computer by any means; cards, paper tape, magnetic tape, or computed and stored by another program. This permits flexibility and does not limit the input of data to one form or another. For plotting it is only necessary to know where the data starts in memory and how many words there are.

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Program Switches:

No. 1 - ON for plotting two sets of data simultaneously

No. 2 - ON if LLL (see Register Settings) points are to be plotted on each graph
OFF for 120 points

No. 3 - ON for repeat of end point (effective only if switch no. 2 is on -- that is, if 120 points per graph are to be plotted with repetition, set switches 2 and 3 on and set LLL equal to 120).

No. 4 - ON for listing the y values.

No. 7 - ON for separating y values from plot (only if LLL is less than 116, See Figs. 2 and 3).

No. 9 - ON if set 2 is in fixed point

No. 0 - ON if set 1 is in fixed point

NOTE: Once a set has been plotted, it is in fixed point and is no longer available in floating point in the computer.

Register Settings:

rA = 0 nnnn 00 aaaa

rR = 0 LLL0 00 bbbb

rP = relative 0000

where: nnnn is the number of points to be plotted

aaaa is the location in memory where data set 1 starts

bbbb is the location in memory where data set 2 starts, if any

LLL is the number of points to be plotted per graph
(21 ≤ LLL ≤ 120)

NOTE: For one set of data and 120 points per graph the R register need not be set.

Ranges:

The range of y is in cells 0150-0152, as in the following examples:

<u>Cell</u>	<u>Quantity:</u>	<u>10 to 38</u>	<u>TO PLOT:</u>	<u>-20 to 30</u>
0150	max y	0 0003 80 0000		0 0003 00 0000
0151	increment	1 0000 10 0000		1 0000 10 0000
0152	min y	0 0000 90 0000		1 0002 10 0000

The value in cell 0152 is the min y to be plotted plus the increment. Also, the increment may be any value, such as 2, 5, etc.

Grids:

Vertical grids can be included on the plots by proper coding of locations 0220 through 0243. Each of these words represents five print locations on the 407 (the sign digit is not used); thus, if vertical grids, using I's, as in Fig. 1, would be desired every ten print locations on the 407, words 0220, 0222, 0224, 0226, etc., would be 0 4900 00 0000, where the 49 is the coding for I.

If no grids are desired, clear locations 0220 through 0243. Following is an example for the system that would be used for hourly data plots with grids every twelve points, where the XX are for midnights and the YY are for noons:

0220	0 XX00 00 0000
	0 0000 00 0000
	0 0000 YY 0000
	0 0000 00 0000
	0 0000 00 00XX
0225	0 0000 00 0000
	0 0000 00 0000
	0 00YY 00 0000
	0 0000 00 0000
	0 0000 00 XX00
0230	0 0000 00 0000
	0 0000 00 0000
	0 YY00 00 0000
	0 0000 00 0000
	0 0000 XX 0000
0235	0 0000 00 0000
	0 0000 00 00YY
	0 0000 00 0000
	0 0000 00 0000
	0 00XX 00 0000
0240	0 0000 00 0000
	0 0000 00 YY00
	0 0000 00 0000
	0 0000 00 0000

If M's are desired at midnight and N's for noon, as is shown in Fig. 2, put XX = 54 and YY = 55.

Modifications:

For plotting to tenths, make the following program changes, which are available on cards:

0015 0 0001 48 0004

0032 0 0001 48 0004

0191 0 8080 03 8000

0245 8 0000 10 0148
0 0000 48 0003
8 8110 40 0191
0 0000 49 0003
8 4110 40 0191

0250 0 0000 49 0001
8 2110 40 0191
8 7000 38 0076
8 0000 10 0191
8 0000 40 0192

0255 8 0000 30 0076

If original data is in fixed point, place the decimal at the fourth place (i.e., $\pm 1234.50\ 0000$).

No data changes are necessary for floating point data.

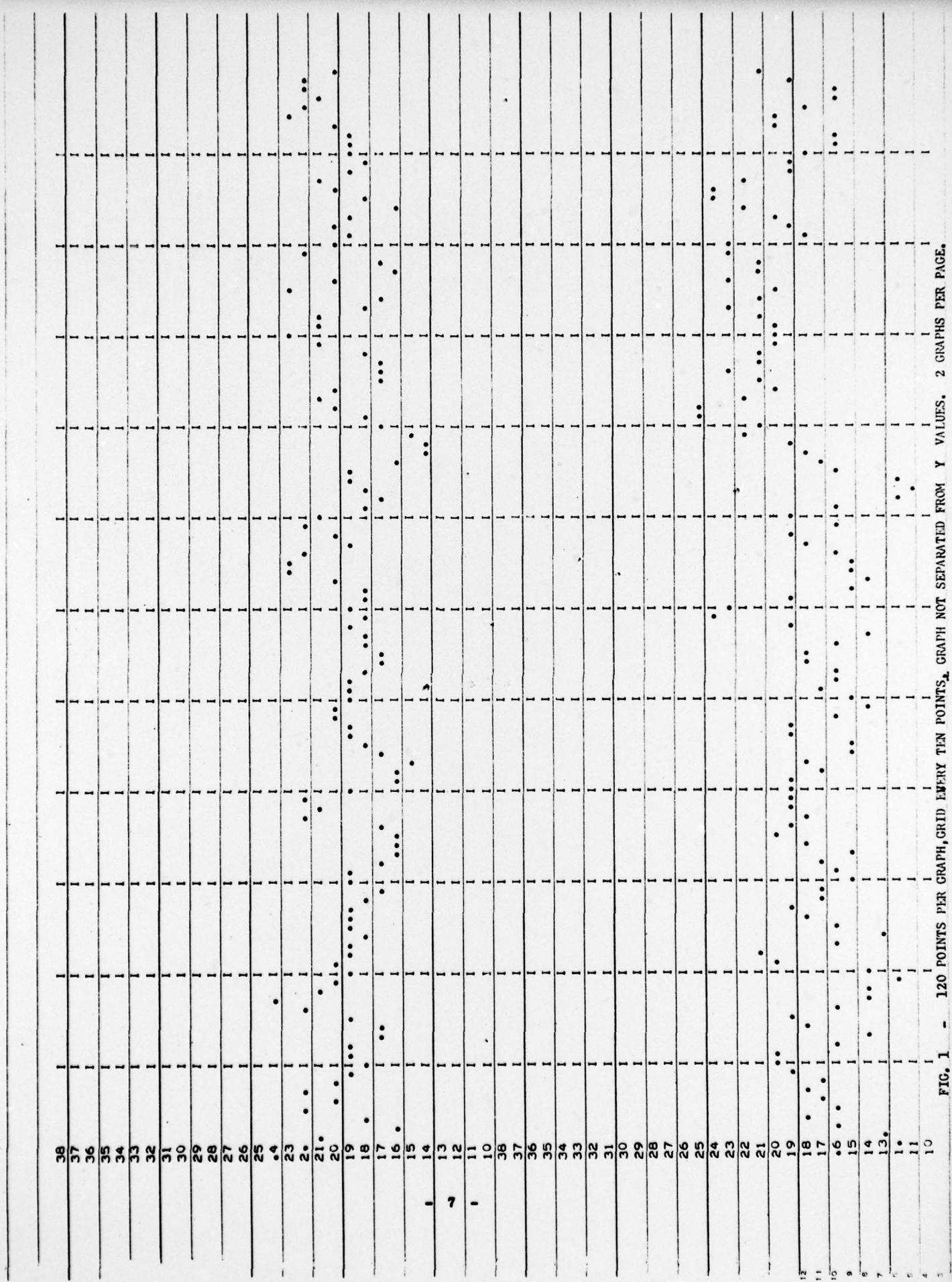


FIG. 1 - 120 POINTS PER GRAPH, GRID EVERY TEN POINTS. GRAPH NOT SEPARATED FROM Y VALUES. 2 GRAPHS PER PAGE.

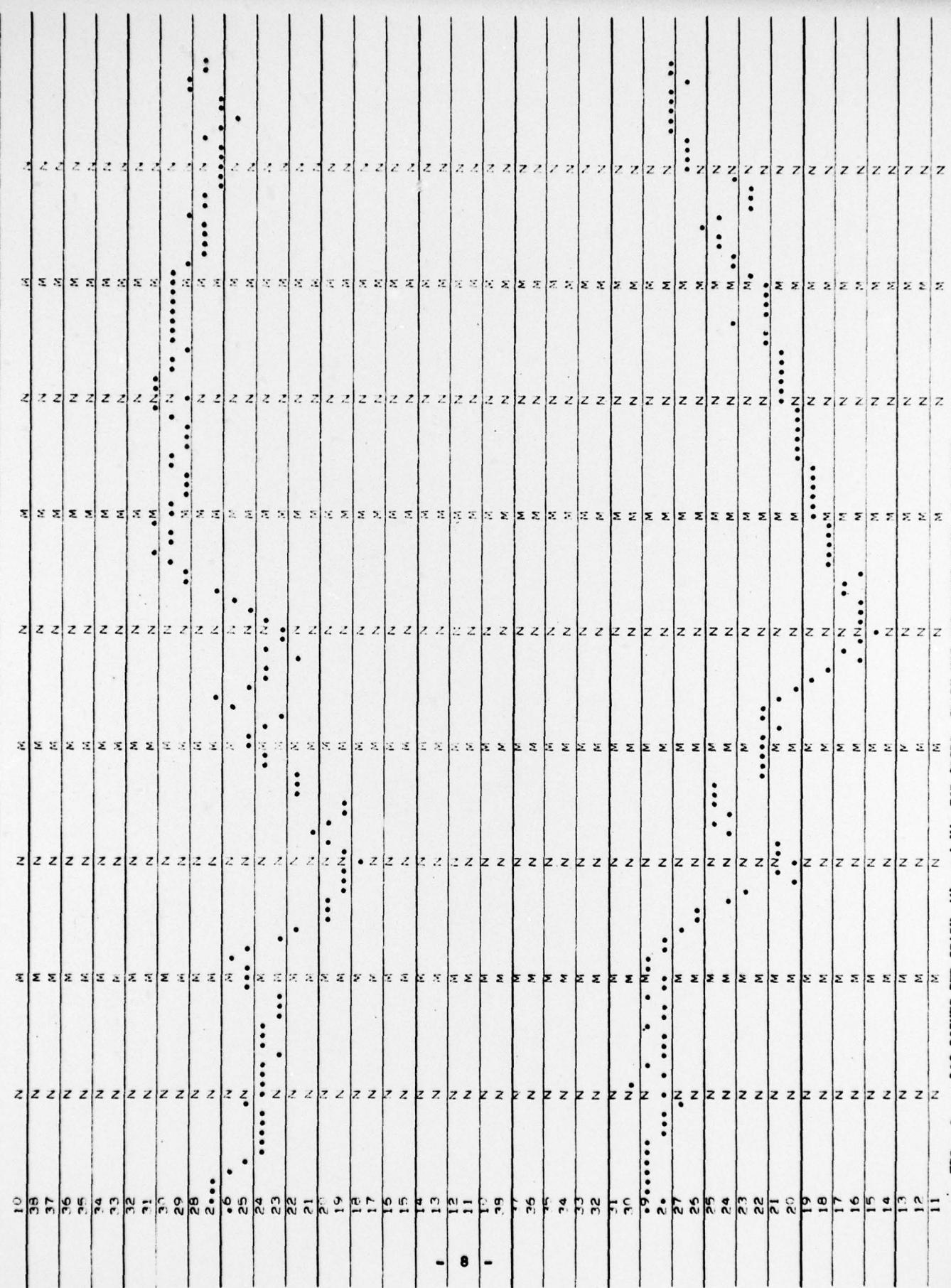


FIG. 2 - 120 POINTS PER GRAPH, M's and N's FOR GRIDS. GRAPH NOT SEPARATED FROM Y VALUES.

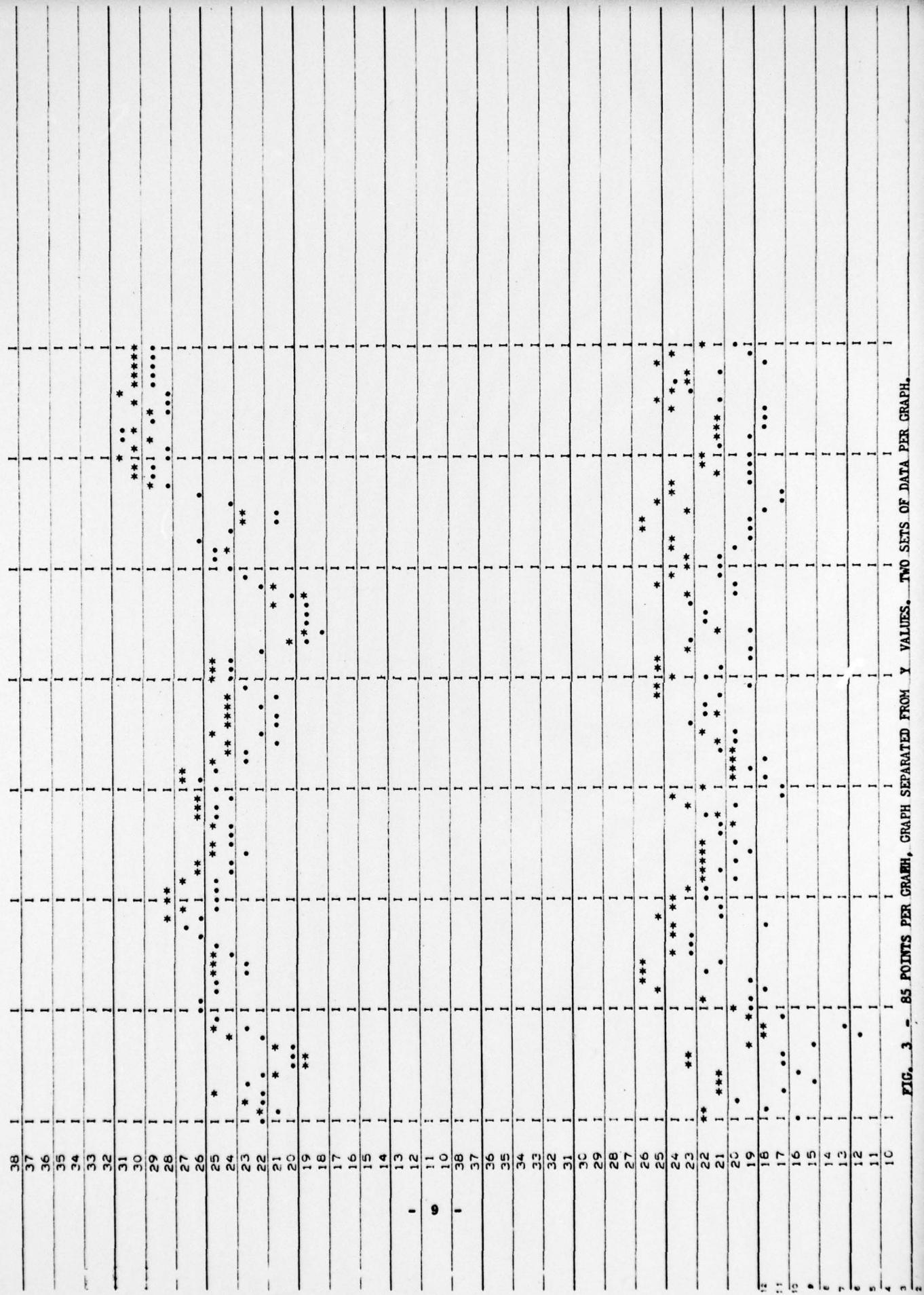


FIG. 3 - 85 POINTS PER GRAPH. GRAPH SEPARATED FROM Y VALUES. TWO SETS OF DATA PER GRAPH.

LISTING OF PROGRAM DECK

000001	0000	8	1000	63	0188	8	0000	40	0155	8	0001	40	0156	8	0410	40	0012	8	0410	40	0018		
000001	0005	8	0410	40	0106	0	0000	48	0006	8	0000	13	0140	8	0410	40	0009	0	0000	01	0000		
000001	0010	8	0000	38	0020	8	0000	42	0009	9	0000	10	0000	8	0000	44	0080	8	0000	30	0081		
000001	0015	0	0001	48	0005	0	0000	16	0000	0	0	0	49	0005	9	0000	40	0000	8	0001	21	0012	
000001	0020	8	1000	38	0022	8	0000	30	0036	8	0000	10	0156	8	0410	40	0029	8	0410	40	0035		
000001	0025	8	0410	40	0101	8	9000	38	0036	0	0000	01	0000	8	0000	42	0009	9	0000	10	0000		
000001	0030	8	0000	44	0080	8	0000	30	0081	0	0001	48	0005	0	0000	16	0000	0	0000	49	0005		
000001	0035	9	0000	40	0000	8	2000	38	0048	8	0000	10	0141	8	0000	40	0149	8	0000	10	0142		
000001	0040	8	4310	40	0129	8	0000	10	0143	8	4210	40	0122	8	4210	40	0123	8	4210	40	0126		
000001	0045	8	4210	40	0127	8	0000	30	0069	0	0000	01	0000	8	0000	10	0156	0	0000	48	0007		
000001	0050	8	0000	40	0157	8	0000	13	0140	8	0000	40	0149	8	3000	38	0056	8	0000	10	0157		
000001	0055	8	0000	30	0057	8	0000	10	0149	8	0000	40	0156	0	0000	49	0006	8	4310	40	0129		
000001	0060	8	0000	10	0158	8	0000	13	0144	0	0000	49	0006	8	4210	40	0122	8	4210	40	0126		
000001	0065	8	0000	10	0144	0	0000	49	0006	8	4210	40	0123	8	4210	40	0127	8	1010	61	0243		
000001	0070	8	0000	10	0150	8	0000	40	0148	8	0000	42	0189	8	0240	29	0220	8	5000	38	0000		
000001	0075	8	4000	38	0245	8	1000	38	0100	8	0000	30	0105	0	0000	00							
000001	0080	0	0000	30	0000	8	0000	36	0080	8	0000	40	0099	8	0001	10	0099	8	0000	12	0097		
000001	0085	8	0000	31	0087	0	0001	45	0000	0	0	2	45	0000	0	0001	48	0008	8	0000	12	0098	
000001	0090	8	0000	40	0092	0	0001	45	0000									16	0000	8	0000	41	0099
000001	0095	0	0001	49	0000	8	0000	30	0080	0	5400	00	000	1	49	0001	0	0000	00				

